Impact of Easing Restrictions on Restaurant Inflation: Normalization Processes in Türkiye during COVID-19

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Abstract

Among the measures implemented in Türkiye during the COVID-19 pandemic, extensive restrictions were applied for restaurants, such as prohibitions regarding dine-in services. As the pandemic was brought under control to a certain degree, restrictions were loosened and normalization processes were begun. In this study, we estimate the causal impact of those normalization processes on restaurant pricing via regression discontinuity design. During the normalization processes that have begun following three main periods of restrictions, an increase of approximately 1.11% and 1.37% in the prices of food services occurred for the first and third normalization periods, respectively, whereas no significant impact is found for the second period.

Keywords: Firm Behaviour, Inflation, Microeconometrics

JEL: L20, E31, C50

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Non-Technical Summary

When the COVID-19 began, many countries introduced restrictive measures against to spread and adjust them according to course of pandemic. While the tightening of the implemented measures caused considerable deteriorations in economic activity across the world, during the normalization periods rising inflation rates became the new concern. Identifying the causal link between the measures and their economic impacts have great importance both for evaluating inflation developments in the post-pandemic period and understanding inflation dynamics in general. The aim of this study is to estimate inflationary impacts of normalization steps on sectoral inflation rate of food services in Türkiye.

The overall COVID-19 experience of Türkiye up to December 2021 can be divided into six main periods, three of which involved the tightening of restrictions and three of which constituted normalization periods. The transitions between these periods had dramatic effects on many sectors of the economy. Food services were particularly affected among these sectors as restaurants were temporarily closed for dine-in services and allowed to provide only takeaway and home delivery during the restriction periods. The simultaneous removal of the restrictions on both human mobility and dine-in services of restaurants during the normalization periods lead enormous and sudden increases in sectoral demand. Indeed, credit card data shows that monthly spending on food services increased remarkably by 134.8%, 45.4%, and 97.2% for the first (June 2020), second (March 2021), and third (June 2021) normalization periods, respectively. The observed rises in the sectoral demand are expected to put upward pressure on the prices. In this study, we try to evaluate causal impact of each of the normalization period on the sectoral food services inflation. Because the decision on the timing for removal of the restrictions given on course of pandemic and they are independent from the sectoral inflation dynamics, normalization steps could be treated as exogenous demand shocks. When the size, exogeneity and suddenness of the shocks generated by normalization steps are considered, a Regression Discontinuity Design (RDD) appears as the best way to measure causal impact.

In this study, we utilize restaurant-product level micro price data from an online food ordering platform that is widely used in Türkiye. One limitation of our dataset is that prices of restaurant which temporarily shut down their operations, cannot be tracked appropriately. Thus, we focus on the prices of restaurant that continued its operation continuously during the restriction periods. Therefore, our estimations can capture only a part of normalization effects.

Our results show that the first and third normalization periods caused average restaurant food prices to increase by 1.11% and 1.37%, respectively. On the other hand, for the second normalization period, no significant impact on the overall food prices of restaurants in Türkiye is found. Considering these findings with the pricing behavior of the restaurants, we argue that rise in the sectoral demand triggers price increases and let developments in inflation expectations and cumulated costs to pass to the prices faster. Therefore, we claim that at least a part of the normalization effect represents the effect of inflation expectations and cost developments.

1. Introduction

As the spread of COVID-19 was brought under control to a certain degree, many countries began implementing normalization programs. Following the easing of restrictive measures taken against the pandemic, economic activity and aggregate demand started to recover, but rising inflation became a new concern. Economists around the world are debating whether these high levels of inflation are transitory or lasting. The best starting point while considering this issue is to identify the factors driving the surge in prices. Increasing commodity prices, expansionary fiscal and monetary policies, accumulated wealth due to decreasing spending during lockdowns, and normalization effects following the easing of restrictions on mobility and the service sector are the factors that are most often proposed. In this study, we evaluate the impact of the last of those, normalization effects, on consumer prices. More specifically, we estimate the causal impact of removing the restrictions on mobility and dine-in services on food prices of restaurants in Türkiye.

When COVID-19 was recognized as a threat for Türkiye, the first order of action was the establishment of the Coronavirus Scientific Advisory Board in January 2020. Subsequently, a series of measures including a switch to online education, restrictions on the services provided in public places, and implementations of lockdowns were applied to control the spread of the virus. These measures were adjusted by that advisory board according to the course of the pandemic, as explained in detail below in Section 2. The overall COVID-19 experience of Türkiye up to December 2021 can be divided into six main periods, three of which involved the tightening of restrictions and three of which constituted normalization periods. The transitions between these periods had dramatic effects on many sectors of the economy. Food services were particularly impacted among these sectors as restaurants were temporarily closed for dine-in services and allowed to provide only takeaway and home delivery during the restriction periods. Since the decisions on the timing of the transitions were based on the course of the pandemic and independent of sectoral developments in food services, they can be considered as essentially exogenous shocks. As explained in Section 2, the nature of the regulations for normalization periods provided a basis for sudden shifts in demand that started immediately after the date of the relevant announcements. Moreover, credit card data show that monthly spending on food services increased remarkably by 134.8%, 45.4%, and 97.2% for the first (June 2020), second (March 2021), and third (June 2021) normalization periods, respectively. As explained in more detail in Section 4 and Section 5.4, such changes in demand conditions triggered restaurants to change their prices and allow the accumulated cost pressures and inflation expectations to pass-through the prices earlier. The impact of normalization processes on prices reflects the effects of increased demand in addition to those accumulated cost pressures and inflation expectations. The exogeneity, suddenness, and the size of the shocks driven by the normalization processes offer a good opportunity to study how prices respond to shocks. In this framework, the sharp regression discontinuity design (RDD) appears to be the best way to identify the causal impacts on prices[1].

In this study, we utilize micro price data from a widely used online food ordering platform. Restaurants registered with this platform i) electronically receive orders for home delivery via the platform in exchange for a proportional fee and ii) also provide dine-in services. Although the sizes of the fees applied by the platform may create differences between the prices for online orders and dine-in prices, they are not expected to create differences in the rates of price changes across those categories. One problem with our dataset is that if restaurants are temporarily shut down, we observe them as new restaurants when they resume operations. Therefore, we reduced our dataset to include only the restaurants that continuously operated during the periods that we analyze, and our results show the impacts of normalization on prices for only these restaurants.

Our baseline results show that the first (June 2020) and third (June 2021) normalization periods caused average restaurant food prices to rise by 1.11% and 1.37%, respectively. On the other hand, for the second normalization period, no significant impact on the overall food prices of restaurants in Türkiye is found. As explained in Section

[1] One may question why the impacts of restrictive periods are not examined in this study. The reason is that demand decreases either began before the announcement of restrictions or the implementations of the restrictions took place gradually. These features of the restrictive periods make RDD inapplicable for the measurement of causal impact. Those readers who are still interested in the estimated impacts of restrictions can review the results of our placebo tests in Section 5. The placebo tests also covered the periods of restrictions and estimation results show no significant impact on prices during those periods.

2, during the second period, provinces were grouped according to the risk of viral transmission and different normalization steps were implemented for each group. We find a significant impact in only one of the four groups with a relatively small value of 0.21%. We also estimate the impact of normalization on specific food product kinds separately to determine whether our baseline results hold for only certain products. Estimations for most of the types of products show consistency with the baseline results. Moreover, to ensure the reliability of our results, we conduct a series of placebo tests and check whether our empirical strategy reveals significant impact in the absence of normalization. The results from these placebo tests leave no doubt about our findings and show that the estimated impacts during the first and third normalization periods clearly stand out in terms of both size and statistical significance.

Furthermore, we examine the pricing behaviors of restaurants and discuss their implications for our results. The data show that, although the frequency of price adjustments increased over time, prices exhibited strong rigidity and the average sizes of absolute price changes fluctuated within a narrow band[2]. These findings reflect menu cost pricing behaviors and have two important implications for our study. First, if restaurants change their prices when the optimum size of the price change reaches a certain threshold[3], then our estimation not only shows the impact of demand shock but also reflects the impact of accumulated costs. Second, because prices show rigidity and not all restaurants revised their prices immediately after normalization, a part of the total normalization effects may be observed when other prices are also adjusted. Therefore, our estimations, which reflect the effects that emerged immediately after normalization, should be considered as reflecting partial normalization effects.

Our study contributes to the literature in several ways. First, our work is relevant to studies focusing on the sharp changes of household consumption driven by the pandemic and their repercussions. The pandemic and related measures caused significant changes in the consumption behavior of households. Cox et al. (2020) utilized bank account data from a US bank and showed that aggregate spending declined sharply in the first months of the pandemic. Their analysis revealed that the decline was more distinct in sectors that represent higher health risks, such as restaurants and accommodation services. Moreover, spending declined more in percentage terms for consumers with higher incomes compared to lower-income households, which were more seriously affected by labor market disruptions. Consequently, they concluded that household income losses were not the main driver of the decline in spending. Chetty et al. (2020), Coibion et al. (2020), Cavallo (2020), Alexander and Karger (2020), and Baker et al. (2020) also studied consumer spending in the US during the pandemic with different datasets and obtained results consistent with those of Cox et al. (2020). Andersen et al. (2020a) conducted a comparable study with data from Denmark and reported similar results as restaurant services were among the most affected sectors. Moreover, they attributed the majority of the overall decline to shutdowns and decreased mobility instead of income losses due to increasing unemployment. Likewise, Chen et al. (2021), Bounie et al. (2021), B. Carvalho et al. (2020), V.M. Carvalho et al. (2020), Andersen et al. (2020b), Chronopoulos et al. (2020), and Kantur and Özcan (2021) showed that in China, France, Portugal, Spain, Sweden, the UK, and Türkiye, respectively, following the spread of COVID-19 and related restrictions, aggregate spending declined dramatically with restaurants and the accommodation sector being affected the most. Although the impact of the pandemic, lockdowns, and other pandemic-related measures on aggregate spending behavior has been sharp and widespread around the world, the causal impact of these drastic changes on prices is not well understood. Our study contributes to the literature by revealing the impact of sharp consumption changes on the food prices of restaurants.

Second, our study contributes to the literature focused on the impact of the pandemic and related measures on consumer prices. Studies investigating the impacts of pandemic measures on prices have largely focused on non-restaurant food prices. Ruan et al. (2021) investigated the behavior of fresh fruit and vegetable prices during the lockdown in China. Their results showed that in the first weeks of the lockdown, prices rose because of supply bottlenecks and then gradually returned to pre-pandemic levels. Akter (2020) conducted cross-country panel data analysis of food prices in 31 European countries and found that prices in countries applying tighter COVID-19 restrictions increased more, mainly due to increased supply chain disruptions. Narayanan and Saha (2021) analyzed

[2] As shown in Section 5, during the period between January 2020 and September 2021, i) the monthly frequency of price increases ranged between 7.1% and 21.2%, ii) the monthly frequency of price decreases ranged between 0.57% and 1.38%, iii) the average size of price increases ranged between 12.1% and 14.2%, and iv) the average size of price decreases ranged between -14.5% and -10.3%.

[3] In other words, when the expected returns of changing the prices become higher than the cost of price adjustment (menu cost).

the case of India and obtained consistent results regarding the impact of lockdowns on food prices. Yürek (2021) identified another channel through which COVID-19 and related measures affected food prices; as households experienced sharp income losses, they switched to food items of lower quality and that reduced the gap between the prices of food products of different levels of quality. Our study makes a contribution to this strand of the literature from two different angles. First of all, to the best of our knowledge, this is the first study examining the impact of COVID-19 restrictions on the food prices of restaurants. Second, we identify a new channel through which measures related to COVID-19 have affected consumer prices. We show that lockdowns and other measures created direct impacts on consumer prices by restricting the ways in which restaurants could serve food.

Furthermore, our study also contributes to the strand of literature that focuses on the dynamics of the restaurant sector. Aaronson (2001), Aaronson et al. (2008), Fougère (2010), Wadsworth (2010), and Aaronson and MacDonald (2006) studied the impacts of increases in the minimum wage on food prices of restaurants and showed that at least a part of the total pass-through into consumer prices happened quickly. Fougère (2010), Gaiotti and Lippi (2008), and Hobijn et al. (2006) studied pricing behavior in the restaurant sector and showed that price revisions of restaurants were consistent with menu cost pricing behaviors. Our study contributes to this body of literature by being, to the best of our knowledge, the first study to evaluate the impact of a demand shock on the food prices of restaurants.

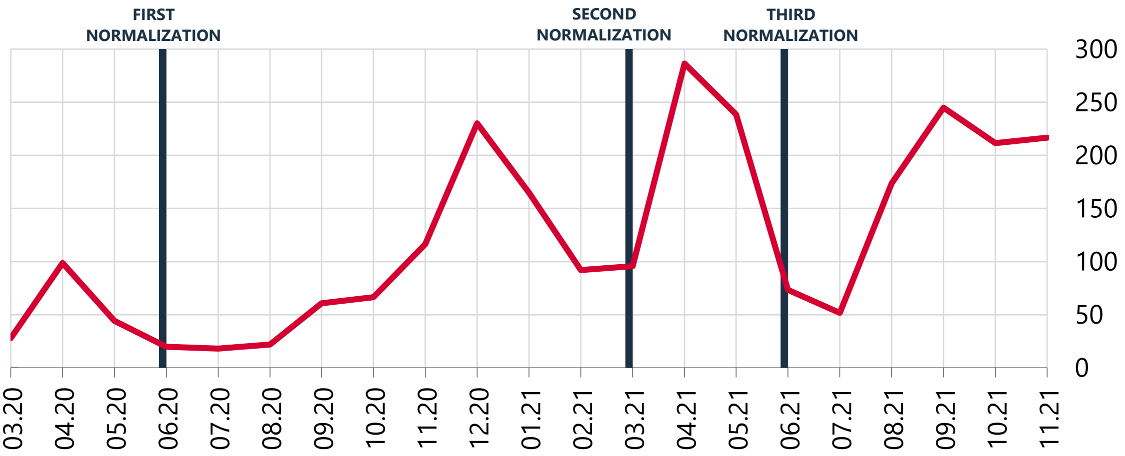
The rest of this paper is structured as follows: Section 2 briefly summarizes the COVID-19 experience in Türkiye. Section 3 describes the dataset, while Section 4 explains the empirical methodology. Section 5 presents the results and a discussion, and Section 6 concludes the work.

2. Background Information

The COVID-19 pandemic began in China and spread around the world in a short time. Many countries took various sanitary, fiscal, financial, and social measures to avoid the negative effects of the pandemic. Türkiye also took strict measures against the pandemic and adjusted those measures according to the course of the spread. The Turkish experience can be divided into six main periods, three of which involved restrictions and three of which involved subsequent normalization periods. In this section, we describe the changes in conditions during the transitions between restriction and normalization periods with special emphasis on measures affecting the restaurant sector.

As the worldwide spread of COVID-19 began, the Coronavirus Scientific Advisory Board was set up by the Turkish Ministry of Health as the first measure in January 2020. In the following days, other precautions such as the installment of thermal cameras at airports and the obligation of wearing surgical masks or quarantining for anyone showing symptoms of infection were applied. In February 2020, Türkiye announced that flights from some countries reporting high numbers of confirmed cases would be halted and the borders with Iran and Iraq would be closed. The first recorded case of COVID-19 occurred on March 11. In the following days, it was announced that education would be conducted online and sports matches would be played without audiences. With the increasing number of confirmed cases, flights from many other countries were cancelled and more borders were closed. The temporary closing of all public gathering places was later announced, such as cafes, gyms, and movie theaters, with the exclusion of shops and of restaurants not offering music. Financial precautions were also taken, such as postponing tax liabilities and the credit debts of employers in the sectors most affected by the crisis. With the increasing spread of the pandemic, sports matches and academic exams were postponed. On March 21, it was announced that, starting from midnight, restaurants, dining places, and patisseries were to be closed to the public for in-house consumption and were only allowed to offer home delivery and takeaway. On April 10, the first lockdown, which lasted for 48 hours, was declared by the Ministry of the Interior for 31 municipalities. Partial lockdowns with individually specified conditions were applied afterwards.

Figure 1: Daily Number of Deaths Due to COVID-19 in Türkiye (Monthly Average, Number of Persons)

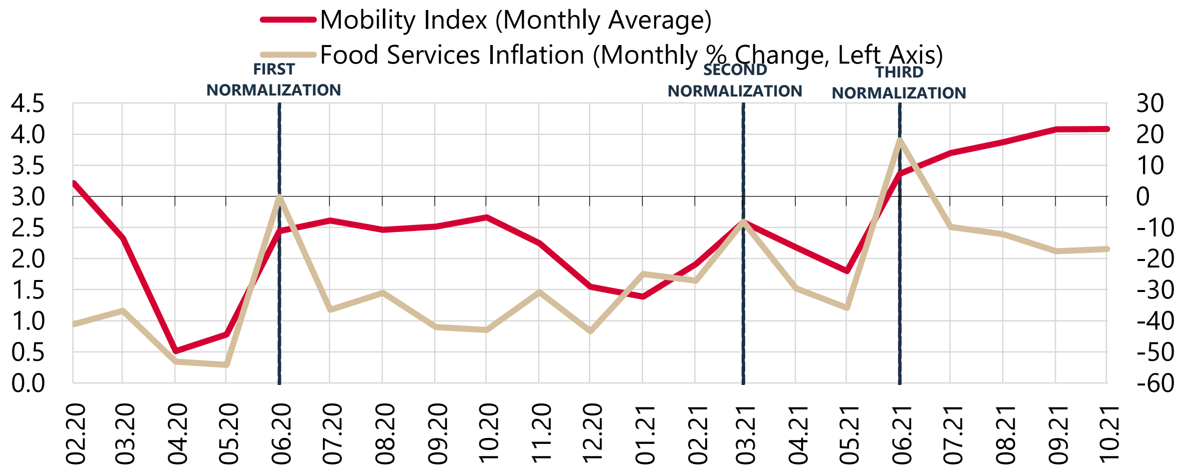


Source: Ministry of Health.

In May 2020, when the number of deaths due to COVID-19 had decreased (Figure 1) and the spread of the virus had declined with the limitations on mobility (Figure 2), it was stated that a return to normal life would happen gradually and regulations regarding the gradual lifting of restrictions would be applied in several steps in May, June, and July 2020. The first normalization process began in June 2020. On June 1, domestic flights resumed and most public spaces were opened again, including restaurants, swimming pools, beaches, parks, libraries, and museums. With this first normalization process, mobility increased (Figure 2), and with the lifting of restrictions on both mobility and restaurants, people began to spend more time outside again. With the reinstatement of flights, the number of tourists also increased, although it remained significantly below the historical averages. As a result of these trends, card expenditures for eating out rose sharply (Figure 3).

In the summer of 2020, with the easing of restrictions, mobility in and out of the country increased and this caused the spread of the virus to increase again. Alongside the delay of vaccination processes in Türkiye, increasing numbers of deaths due to COVID-19 required new measures as autumn approached. In November 2020, new measures were announced to control the spread of the virus, with lockdowns to be imposed on the weekends outside the hours of 10:00 am–08:00 pm, restaurants only providing delivery services, and shopping malls and markets closing at 08:00 pm.

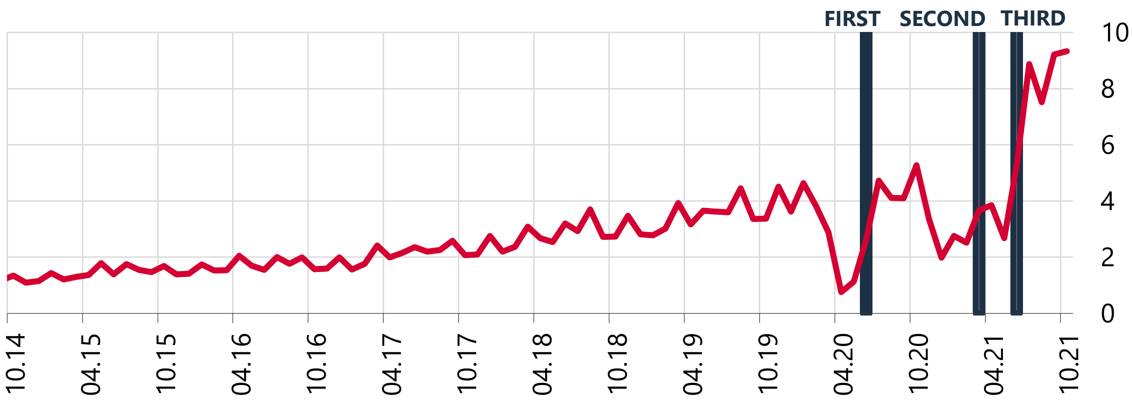
Figure 2: Mobility Index* and Food Services Inflation



Source: Google Mobility Index, TURKSTAT.

* Monthly averages of the "Retail and Recreation," "Grocery and Pharmacy," and "Workplaces" groups from Google Mobility Indices.

Figure 3: Card Expenditures Related to Food (Billion TRY)



Source: Central Bank of the Republic of Türkiye.

After the spread of that second COVID-19 wave was brought under control to a certain degree and the vaccination process began in Türkiye on January 13, a second normalization process was implemented in late February of 2021. In this period, according to criteria determined by the Coronavirus Scientific Advisory Board, the provinces of Türkiye were divided into 4 different groups of low, medium, high, and very high risk and the degree of measures to be taken to combat the pandemic was determined according to those risk groups, color-coded as blue, yellow, orange, and red, respectively. Different measures were applied for the provinces in each risk group (Table 1)[4]. For the provinces coded with blue and yellow, in-restaurant dining was allowed at 50% capacity between 07:00 am and 07:00 pm, while between 07:00 pm and 09:00 pm only takeaway or home delivery was available. Between 09:00 pm and 12:00 am, only home delivery was allowed. For orange-colored provinces, lockdowns were implemented on Sundays, so only home delivery or takeaway were allowed between 10:00 am and 08:00 pm while, between 08:00 pm and 12:00 am, only home delivery was available. Measures were the same on Saturdays as for blue and yellow provinces. For red provinces, restaurants remained closed to in-house dining, so between 10:00 am and 08:00 pm only takeaway or home delivery was allowed, while between 08:00 pm and 12:00 am only home delivery was

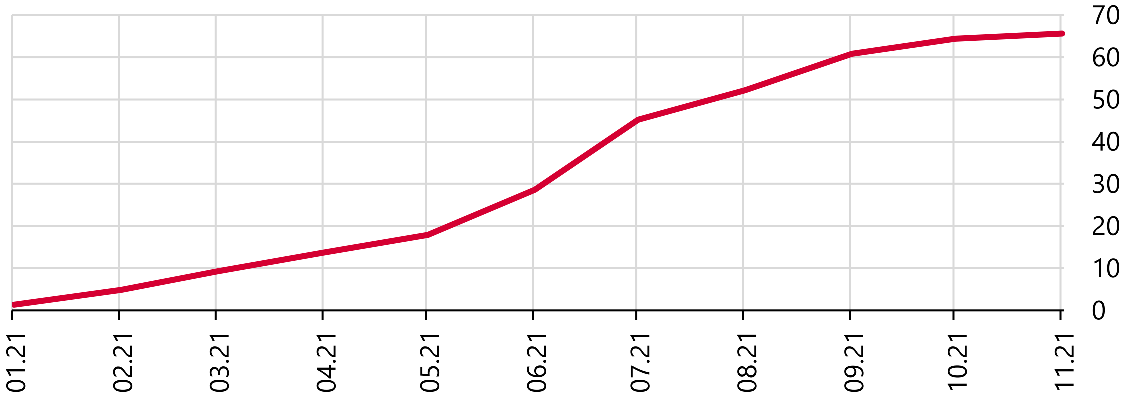
[4] The risk groups to which the provinces belonged changed approximately by the month as more confirmed cases were reported in each province. However, as our focus here is on the impacts arising from the beginnings of the normalization processes, these changes in risk groups are not within the scope of this work.

allowed. Following the second normalization, card expenditures for eating out rose again, but the size of the increase was trivial this time.

After the reduction of restrictions, the number of deaths due to COVID-19 peaked again. Therefore, measures were tightened again. Partial lockdowns were imposed again after certain times on weekdays and all day on weekends. Furthermore, restaurants, dining places, and patisseries were to be closed to in-house food consumption again; they were only allowed to offer home delivery and takeaway. Moreover, in the period between April 29 and May 17, a 17-day full-time lockdown was imposed to take further control of the spread of the virus. After that strict lockdown, policies returned to those of former partial lockdown conditions again.

As the third wave of COVID-19 was taken under control, another normalization period was introduced in June 2021. Lockdowns were reduced to all day on Sundays and, after a certain time for other days, travel between provinces was allowed and public spaces were re-opened, including restaurants, with certain requirements for social distancing. This period generated the sharpest jump in credit card expenditures for the service sectors of eating out and travel. As the vaccination rate also started to climb in June 2021, lockdowns were not continued, replaced only with the warning to be careful of the pandemic in July 2021.

Figure 4: Daily Vaccination Rate of Türkiye (Monthly Average)



Source: Our World in Data.

Table 1: June 2020, March 2021, and June 2021 Normalization Conditions for Restaurants

	June 2020	March 2021*	June 2021
Pre-Normalization Conditions	Only takeaway or home delivery	Weekdays: Takeaway and home delivery between 10:00 am and 08:00 pm Home delivery after 08:00 pm Weekends: 10:00 am-08:00 pm home delivery	Weekdays: Takeaway or home delivery between 07:00 am and 08:00 pm; home delivery between 08:00 pm and 12:00 am Weekends: Home delivery between 07:00 am and 12:00 am
Post-Normalization Conditions	Service at the table, takeaway, or home delivery with social distancing rules applied to seating, until 10:00 pm	Blue and yellow: 50% capacity between 07:00 am and 07:00 pm 07:00 pm to 09:00 pm takeaway or home delivery 09:00 pm to 12:00 am home delivery Orange: 50% capacity between 07:00 am and 07:00 pm; 07:00 pm to 09:00 pm takeaway or home delivery; 09:00 pm to 12:00 am home delivery Sunday: 10:00 am-08:00 pm takeaway or home delivery; 08:00 pm-12:00 am home delivery Red: 10:00 am-08:00 pm takeaway or home delivery; 08:00 pm-12:00 am home delivery	Weekdays and Saturdays: Service at tables with social distancing, takeaway, or home delivery between 07:00 am and 09:00 pm; home delivery between 09:00 pm and 12:00 am Sunday: 07:00 am to 12:00 am only home delivery

Source: Ministry of Interior.

* Numbers of provinces by color: Blue (14), Yellow (28), Orange (22), Red (17).

In short, Türkiye experienced three main restrictive periods, each of which were followed by a normalization period. When these transitions from a restrictive period to a normalization period are compared, the degree of relaxation was particularly modest in the second period (March 2021). Consistent with this observation, jumps in the mobility index and credit card expenditures in the first (June 2020) and third (June 2021) periods were significantly higher than those in the second period.

3. Data

In this study, we utilize a dataset containing data on the online food prices of restaurants in Türkiye. These data are not official CPI data, but they do have representative power of official data. The prices that we have used were retrieved from an online food ordering platform, one of the most dominant platforms in this sector. Most restaurants registered with this platform provided both dine-in and food delivery services during the pandemic[5]. Restaurants pay proportional fees to the platform based on total order amounts. This fee may differ between dine-in and delivery prices, but the rate of change in these prices may be expected to be the same unless the platform changes the amount of the fees.

Prices were collected twice a month, mostly around the 10th and 20th days of the relevant month. In the data that we have reviewed here, the restaurant names are masked with ID numbers. One problem with the data obtained in the course of this research is that if a restaurant shut down its operations and later re-entered the market, its re-entry would be noted with a new ID number. This prevented us from following the prices of restaurants that were temporarily closed during the pandemic. Therefore, we reduced our dataset to the restaurants that were continuously operating during the period between January 2020 and October 2021. Our final dataset contained prices for 34369 different food products classified into 10 different 7-digit COICOP classes from 11892 different restaurants in Türkiye (Table 2). Products that showed price changes greater than 75% or lower than 55% were treated as outliers and excluded from the analysis[6].

Table 2: Number of Restaurants and Observations by Product Kinds

		Number of Restaurants	Number of Products
1110101	Soups	4334	6091
1110102	Cold meals	3954	4458
1110103	Broiled meat (kebab)	3971	4917
1110104	Flat bread (pide, lahmacun)	3189	5649
1110105	Steak tartar a la turca (cig kofte)	2054	2054
1110106	Doner in bread	2503	4853
1110108	Hamburgers and sandwiches	2964	3725
1110110	Pizzas	1249	1249
1110113	Patisserie products (takeaway)	493	682
1110115	Desserts in restaurants	654	691
Total Number of Restaurants			11892
Total Number of Products			34369

Source: Authors' calculations.

[5] The restaurants could choose between either employing their own delivery staff or using this platform's delivery services in return for an additional fee.

[6] The number of excluded products was 3848, representing 2.2% of the final dataset.

4. Empirical Strategy

During the periods of restrictions applied for COVID-19 in Türkiye, restaurants were forbidden to provide in-person service and could allow only home delivery or takeaway. Because the restaurants we analyzed here previously provided both home delivery and dine-in services in the absence of pandemic measures, during the restriction periods they lost large segments of their customer bases and the demand for food services decreased. In parallel, credit card data show that spending on food services significantly decreased during the restriction periods. On the other hand, as normalization processes eased the restrictions on dine-in services, the demand for dine-in services recovered quickly, as also reflected by credit card data. Since the sharp increase in spending took place rapidly, comparing the restaurant prices before and after these normalizations will provide valuable information about the impact of increasing demand on prices. However, as explained more in Section 5.4, when prices show rigidity and the changing of prices is costly for restaurants (menu cost), comparisons of pre- and post-normalization prices will not reflect the isolated impact of demand increases. As restaurants adjust their prices only when the expected profit of a price change covers the menu cost, the effect of normalization on change in prices will reflect not only the impact of increasing demand but also accumulated cost pressures and changes in inflation expectations.

Our main target in this study is to evaluate the impact of normalization steps on restaurant prices. Since i) striking demand increases took place immediately after announcements of normalization processes and ii) because decisions at the beginning of the normalization processes were independent of sectoral dynamics, normalization processes can be utilized as natural experiments. In other words, when the size, suddenness, and exogeneity of shocks are considered, normalization processes provide ideal conditions, nearly on the level of randomized experiments, to measure impacts on restaurant prices.

Sharp regression discontinuity design (RDD)[7] accordingly appears to be the best method for the estimation of impact. Therefore, we estimate the following equation:

$$100 * \ln(\boldsymbol{price})_{it} = \underbrace{\boldsymbol{\alpha} + \boldsymbol{\beta D}}_{\text{I}} + \underbrace{\sum_{k=1}^{K} \boldsymbol{\gamma}_{1k} \boldsymbol{D} * (\boldsymbol{R} - \boldsymbol{c})^{\boldsymbol{k}}}_{\text{II}} + \underbrace{\sum_{k=1}^{K} \boldsymbol{\gamma}_{2k} * (1 - \boldsymbol{D}) * (\boldsymbol{R} - \boldsymbol{c})^{\boldsymbol{k}}}_{\text{III}} + \boldsymbol{\mu}_{i} \quad (1)$$

Here, $\boldsymbol{i}$ and $\boldsymbol{t}$ are the indices for the product in a restaurant and time, $\boldsymbol{D}$ is a dummy variable that takes the value 0 for the pre-normalization period and 1 for the post-normalization period, $\boldsymbol{R}$ is a linear time trend[8] (or running variable), $\boldsymbol{c}$ is the discontinuity point that shows the date when a normalization process began, $\boldsymbol{k}$ is the order of the polynomial, $\boldsymbol{\mu}_i$ shows the fixed effects for each product sold in each restaurant[9], and $\boldsymbol{\beta}$ shows the normalization effect. In this equation, Part I represents the normalization effect, Part II represents the post-normalization time trend, and Part III represents the pre-normalization time trend. This formulation allows the pre- and post-normalization trends to be different. In Equation 1, we present a general form of an RDD equation that allows the use of higher-order polynomials. However, as our estimation sample cover limited numbers of time periods, the use of higher-order polynomials would be problematic. Therefore, we have followed the advice of Gelman and Imbens (2019) and we focus on the equation with the first-order polynomial[10].

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[7] For detailed information on RDD, see Angrist and Pischke (2008), Imbens and Lemieux (2008), and Lee and Lemieux (2010). For detailed information and applications regarding time as a running variable in RDD, see Hausman and Rapson (2018), Aysoy et al. (2015), and Davis (2008).

[8] As noted in Section 3, the frequency of our data is not fixed and we observed these prices around the 10th and 20th days of the relevant month. The variable $\boldsymbol{R}$ counts the days from the beginning. For example, if the first three dates of the sample that is used for the estimation are April 10, April 22, and May 9, 2021, the variables take values of 1, 13, and 30, respectively.

[9] For example, if the sample contains individual price series for 10000 different products, then there will be 10000 different product dummies. These dummies also control all types of time-invariant features such as city fixed effects and restaurant fixed effects.

[10] For readers who are interested in estimation results from this equation including higher-order polynomials, we present the results from the equation including second-order polynomials in the Appendix.

The selection of the window size is also a crucial decision in estimation. The window size defines the time period covered by the sample; for example, if the window size is 4 months, the analysis will cover the period spanning the 2 months before and the 2 months after the start of the normalization period. A small window size would decrease the time dimension of the sample, which would reduce the degrees of freedom. On the other hand, large sizes of windows create the possibility of facing other effects rather than normalization processes that may affect increased prices of food services. Therefore, we conducted our estimations for alternative window sizes. The other decision that should be made carefully here regards the statistical significance of the estimate. As the values of policy variable $\boldsymbol{D}$ change by dates of observation, standard errors should be clustered at the level of the date of observation. Because the numbers of clusters are limited in our analysis, we applied the wild bootstrap method (Cameron, Gelbach, & Miller, 2008). As the distribution identified based on the wild bootstrap method did not need to be symmetric, we have provided confidence intervals calculated from the bootstrap values.

5. Results and Discussion

In this section, we first present our results for the overall impacts of normalization processes on overall food services prices in Türkiye. Furthermore, for each risk group defined here, we consider the second normalization process. We then present the results for impacts on 7-digit COICOP product classes and the results of placebo tests. Finally, we analyze sectoral pricing behaviors and discuss their implications for our results.

5.1. Impact on Food Service Prices

Before moving on to the empirical results, Figure 5, Figure 6, and Figure 7 are provided to help visualize the validity of RDD. While the vertical axis shows the logarithmic averages of prices for the products in the dataset in these figures, the horizontal axis shows the dates. Red dots in the figures indicate the logarithmic averages of online prices of the product varieties and dark blue dots show the average logarithmic prices of food services. All series are normalized with 02.10.2020=0. The beginnings of the normalization periods are represented by vertical dashed lines. This graphical analysis of average product and food service prices reveals a spike at the beginnings of the first and third normalization periods, whereas there is no dramatic jump for the second normalization process. After reviewing these figures, to obtain more reliable results and check their statistical significance, we move on to the results for Equation 1.

Table 3 presents the estimates of the effects of normalization with alternative window sizes. The results for a 4-month window size, which is our preferred size, reveal the impact of normalization on food services prices for the first and third periods to be approximately 1.11% and 1.37%, respectively. However, for the second period, while there is a somewhat effect for the high-risk group of provinces color-coded as orange[11] at about 0.21%, no significant effect is obtained for the other risk groups or for Türkiye as a whole. Moreover, the alternative choices of window size produce similar results, except for the third period. The possibility of encountering confounders, such as cost shocks observed in the later periods, increases while enlarging the window size, and so we prefer to rely on results obtained with the 4-month window size.

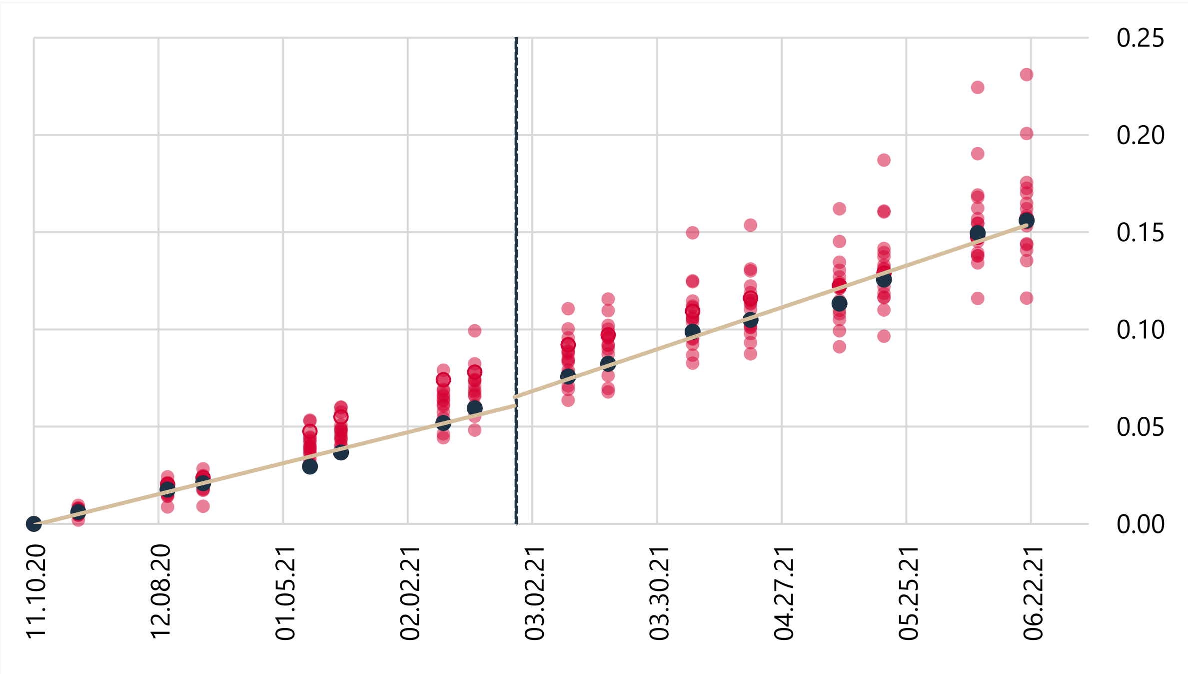
When the differences between the restrictions for restaurants before and after the normalization periods are compared, the least easing of restrictions is observed in the second period. While the strict rules were notably loosened for all of Türkiye in the first and third normalization periods, they were eased partially in the second normalization period to extents that differed across the country. Furthermore, card expenditures related to eating out show the least increase in spending during the second period. Against this background, the sizes of the estimated impacts seem consistent with the developments in demand for the related periods.

[11] The orange-coded group included Istanbul and Izmir, which are the first and third most populous provinces in Türkiye. A map of the provinces with the color-coded groups that they belonged to is presented in the Appendix.

Figure 5: Average Food Service Prices Before and After the First Normalization (June 2020)

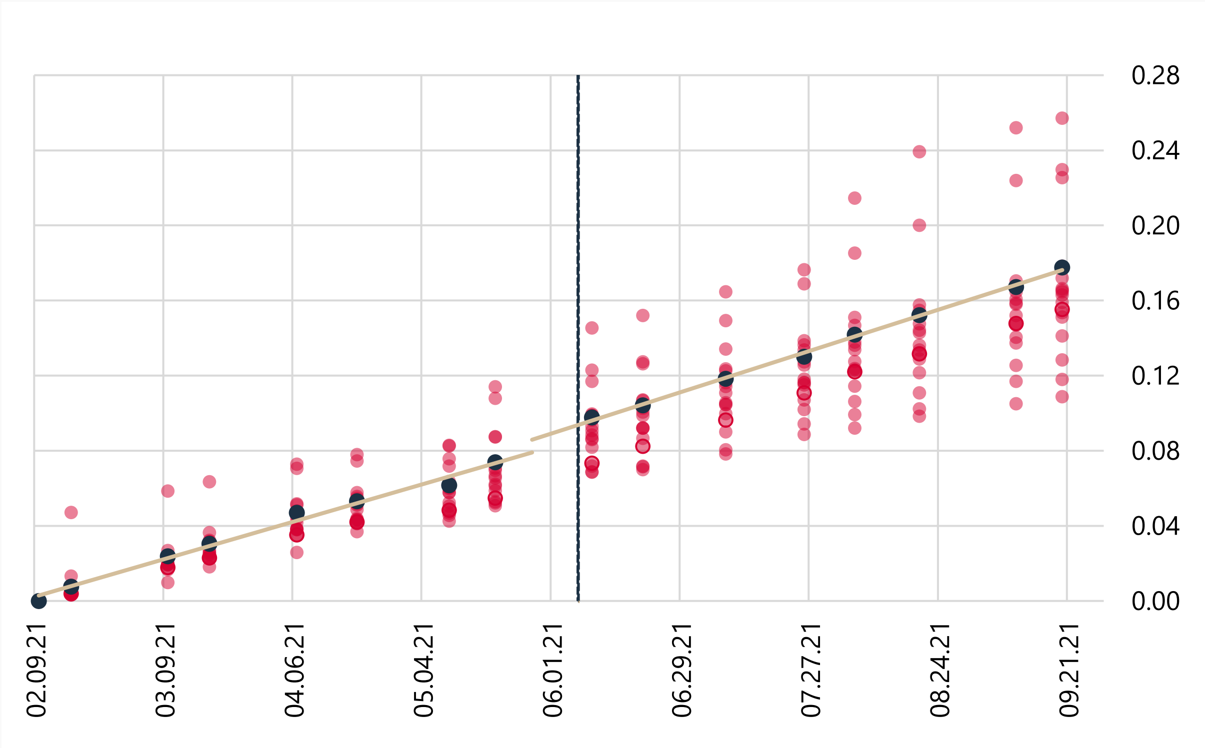
Source: Authors' calculations.

Figure 6: Average Food Service Prices Before and After the Second Normalization (March 2021)



Source: Authors' calculations.

Figure 7: Average Food Service Prices Before and After the Third Normalization (June 2021)



Source: Authors' calculations.

Table 3: Effects of Normalization in June 2020, March 2021, and June 2021

Window Width		4 Months	6 Months	8 Months
June 2020		1.11*** (0.88, 1.36)	1.11*** (1, 1.27)	1.09*** (0.96, 1.2)
March 2021	Türkiye	0.15 (-0.78, 0.71)	0.26 (-0.13, 0.82)	0.26 (-0.19, 0.81)
	Blue	-0.58 (-1.91, 0.43)	-0.6 (-1.6, 0.31)	-0.32 (-0.87, 0.47)
	Yellow	0.24 (-1.09, 0.94)	0.23 (-0.21, 0.78)	0.13 (-0.42, 0.57)
	Orange	0.21** (-0.51, 0.65)	0.38* (-0.06, 0.97)	0.41** (0, 0.95)
	Red	-0.44 (-1.46, 0.29)	-0.36 (-0.82, 0.08)	-0.32 (-1.25, 0.83)
June 2021		1.37** (0.71, 2.62)	1.01** (0.2, 1.77)	0.75* (-0.08, 1.45)

***, **, and * show statistical significance at 1%, 5%, and 10% levels, respectively. While the confidence intervals presented in the parentheses were calculated, standard errors were clustered by the date of observation and the wild bootstrap method (Cameron, Gelbach, & Miller, 2008) was applied.

Source: Authors' calculations.

5.2. Impact by Product Types

In order to check whether the impacts were homogeneous across product types, we implement further analyses for each product group. The results provided in Table 4 show that the first and third normalization periods had positive and significant effects on almost all subgroups. However, the size of the estimated impacts varies across products types. When the second normalization period is considered, although significant and positive impacts are seen for some products, especially for the orange-coded provinces, this trend is not as widespread as in other periods, especially for Türkiye as a whole. These estimations for each product separately also serve as a robustness check. The widespread impacts confirm that our baseline results are not dominated by any subgroups.

Table 4: Effects of Normalization in June 2020, March 2021, and June 2021 (Window Size: 4 Months)[12]

	By Products						
	June 2020	**March 2021**					**June 2021**
		Türkiye	**Blue**	**Yellow**	**Orange**	**Red**	
Soups	1.19** (0.84, 1.6)	0.02 (-0.16, 0.44)	-	0.41* (-0.09, 0.92)	-0.04 (-0.27, 0.65)	-0.5 (-1.59, 0.68)	1.02** (0.37, 1.71)
Cold meals	1.4** (1.17, 1.73)	0.36** (0.03, 0.74)	-	0.51*** (0.22, 0.77)	0.45* (-0.06, 1.02)	-0.6** (-1.03, -0.15)	1.41** (0.03, 2.44)
Broiled meat (kebab)	1.31** (1.03, 1.73)	0.4** (0.17, 0.67)	-	0.67*** (0.58, 0.87)	0.42** (0.03, 0.78)	-0.39* (-0.96, 0.26)	1.76** (0.04, 2.97)
Flat bread (pide, lahmacun)	1.03** (0.75, 1.35)	0.24** (0.01, 0.61)	-	0.14 (-0.17, 0.55)	0.46** (0.14, 0.86)	-0.68* (-1.52, 0.38)	1.46* (-0.33, 2.52)
Steak tartar a la turca (cig kofte)	0.37** (0.02, 0.65)	0.01 (-4.13, 6.9)	-	-0.44 (-5.27, 7.5)	0.19 (-3.44, 6.04)	0.56 (-4.09, 8.37)	0.54* (-0.29, 1)
Doner in bread	1.53*** (1.3, 1.82)	0.73** (0.29, 1.3)	-	0.64** (0.26, 1.12)	0.84** (0.3, 1.49)	0.39 (-0.61, 1.73)	1.78** (0.95, 3.3)
Hamburgers and sandwiches	0.72** (0.42, 1.08)	-0.99* (-3.04, 1.26)	-	-0.35 (-2.17, 1.72)	-1.12* (-3.19, 1.33)	-1.73* (-3.63, 0.32)	2.08** (-1.8, 4.31)
Pizzas	0.41** (0.11, 0.57)	-0.08 (-4.22, 2.9)	-	-0.53 (-3.36, 1.92)	0.3 (-4.77, 3.6)	-0.86 (-5.91, 2.4)	-0.77 (-8.38, 4.09)
Patisserie products (takeaway)	0.9** (0.41, 1.11)	-0.29 (-0.78, 0.53)	-	0.14 (-1.37, 2.33)	-0.36 (-0.75, 0.24)	-	0.55 (-1.29, 1.6)
Desserts in restaurants	0.66** (0.53, 0.94)	0.72** (0.08, 1.18)	-	0.08 (-0.63, 0.61)	1.07** (0.05, 1.81)	-	1.17* (-0.4, 1.99)

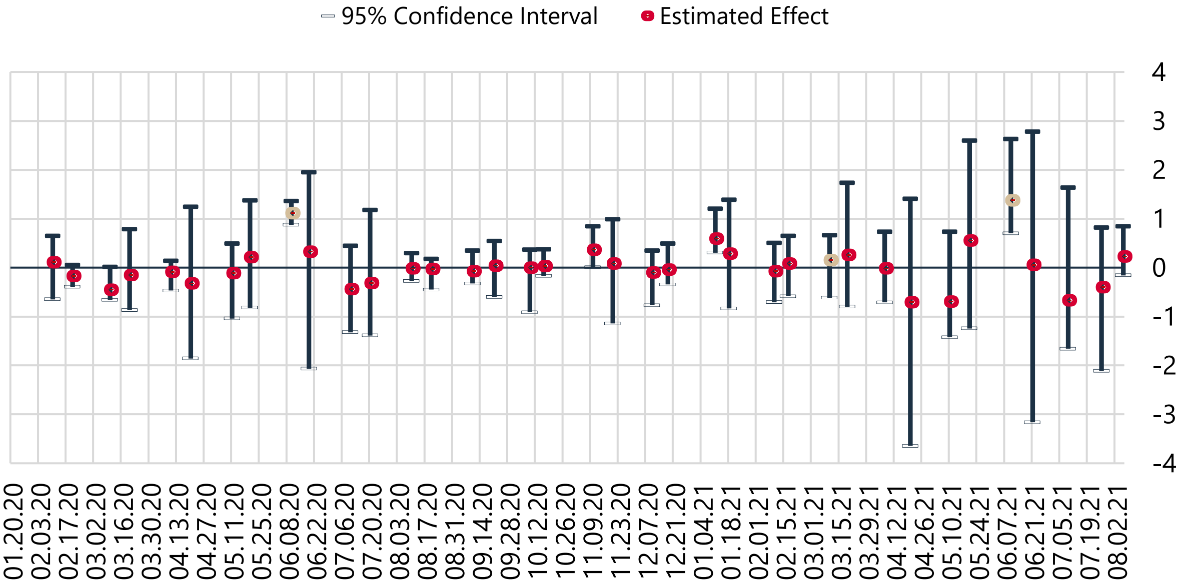
***, **, and * show statistical significance at 1%, 5%, and 10% levels, respectively. While the confidence intervals presented in the parentheses were calculated, standard errors were clustered by date of observation and the wild bootstrap method (Cameron, Gelbach, & Miller, 2008) was applied.
Source: Authors' calculations.

[12] The results for the blue-coded group of provinces and some products for the red-coded group are not presented due to insufficient numbers of observations.

5.3. Placebo Tests

In addition to the analyses presented above, a series of placebo analyses were performed to test the reliability of the estimates presented in this study. Each observation date in the dataset was treated as if it were the beginning of a normalization period, and the same analysis used to obtain the baseline results was applied. As presented in Figure 8, the estimated impacts of the first and third normalization periods stand out notably in both size and statistical significance. In addition, according to the results of 34 placebo tests, there are only two significant effects[13]. This high rate of rejection in the absence of normalization confirms the reliability of our results.

Figure 8: **Placebo Test Results***



Source: Authors' calculations.

* The 4-month window size and linear form were chosen for all of the presented estimates, as in the base model. While calculating the confidence intervals, the standard errors were grouped according to the date of observation and the wild bootstrap method (Cameron, Gelbach, & Miller, 2008) was applied.

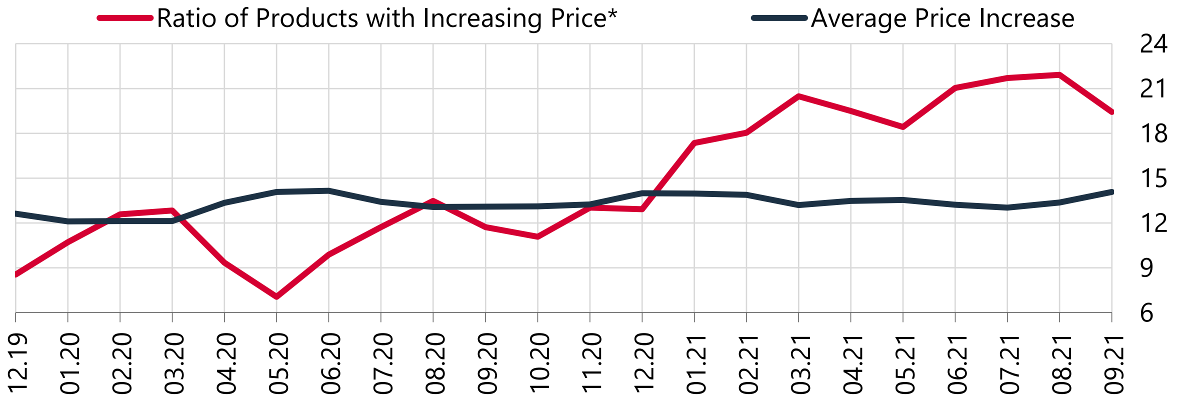
5.4. Pricing Behavior and Its Implications for Our Results

Our aim in this paper is to identify the impact of normalization effects on the food prices of restaurants. To interpret our results accurately, it is first necessary to understand the general pricing behavior of restaurants. Fougère (2010), Gaiotti and Lippi (2008), and MacDonald et al. (2008) showed that food prices of restaurants reflected significant rigidities in France, Italy, and the United States, respectively. Fougère (2010), Gaiotti and Lippi (2008), and Hobijn et al. (2006) showed that menu cost pricing behavior offers a good explanation of the changes in food prices of restaurants. Similar patterns are also observed in our data. The black line in Figure 9 (Figure 10) shows the number of price increases (decreases) per product in a given month and the red line shows the average size of the price increases (decreases). The data indicate the presence of price rigidity in Türkiye, but it is relatively low considering that the monthly frequency of price changes was found to be 4.16% for traditional restaurants and 9.41% for fast-food restaurants in France (Fougère, 2010), the bimonthly frequency of changes was reported to be about 13% in the United States (MacDonald et al., 2008), and the annual frequency of change was calculated as 40% in Italy (Gaiotti and Lippi, 2008). There are two other points worth noting here: i) the frequency of price increases shows significant changes, whereas the frequency of price decreases and the average size of individual price changes

[13] One of two significant effects is seen in January, when the minimum wage was increased. Therefore, the estimated significant impact may be the result of the increase in minimum wage.

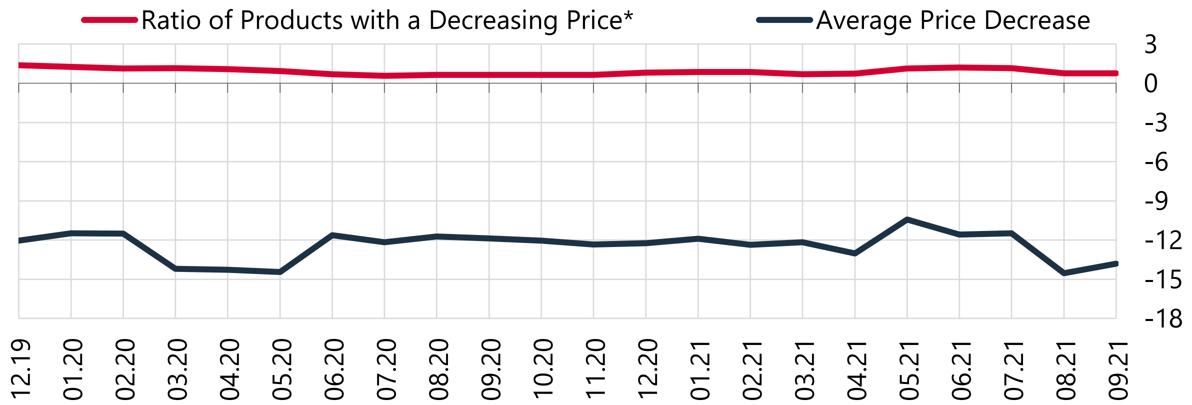
fluctuate within a narrow margin during the period that we analyze in Türkiye; and ii) the frequency of price decreases constitutes only a tiny part of the total frequency of price changes.

Figure 9: **Frequency of Price Increases and Average Size of Price Increases**



Source: Authors' calculations.
* Obtained by dividing the number of increases seen in the prices of products followed during the month by the total number of products.

Figure 10**:** Frequency of Price Decreases and Average Size of Price Decreases



Source: Authors' calculations.
* Obtained by dividing the number of decreases seen in the prices of the products followed during the month by the total number of products.

These observations show that the pricing behavior of restaurants in Türkiye is also consistent with menu cost pricing. The rigidity in prices and the almost flat shape of the average size of price increases fit into a pricing model where i) price changes are costly for restaurants and ii) restaurants change their prices when the gap between the optimal price and the present posted price exceeds a certain threshold. These observations have two important implications for our results. First, our empirical strategy can identify the impact that passes into the food prices of restaurants at the beginning of normalization period, but only some of the posted prices were adjusted in this period. Therefore, our estimation can capture only a part of the total normalization effect, and the rest of it comes to light when additional cost and demand pressures hit the restaurants. Second, we interpret our estimation as the effect of normalization, which is the difference between the observed prices and counterfactual prices that would have been observed in the absence of normalization. However, attributing the whole estimated impact to the increased demand generated by normalization may be misleading. As the data suggest, firms revise their prices when the accumulated need for price increases reaches a certain level. As the demand shock widens the gap between the posted prices and optimum prices, it triggers price revisions. This means, for example, that the pass-through of accumulated cost pressures into prices, which is expected to take a longer time in the absence of shock, gains speed and is completed earlier due to the demand shock. In short, we believe that at least a part of the estimated normalization effect reflects the cost developments.

6. Concluding Remarks

The COVID-19 measures applied in Türkiye resulted in sharp changes in the activities of restaurants. They were closed for dine-in services and allowed to provide only takeaway and home delivery services during three different periods. During the normalization processes that began after each of these periods of restriction, the lifting of the restrictions generated enormous demand increases for food services. In this paper, we have investigated the causal impact of the normalization processes on food prices of restaurants in Türkiye with sharp RDD as a quasi-experimental micro-econometric technique. Because of the structure of our dataset, we were able to estimate only the impact on the prices of restaurants that continuously operated during the period that we analyzed. We found that the first and third normalization periods had upward impacts of approximately 1.11% and 1.37% on the food prices of restaurants, while there was no significant impact of the second normalization period. Moreover, we analyzed the pricing behavior of the restaurants and reviewed their implications for our results. The empirical evidence presented here shows that restaurants' pricing behaviors fit the framework of menu cost pricing and suggest that i) when demand shock triggers price changes, the accumulated cost pressure also passes through the prices, so our estimations show not only the impact of demand shock but also the impact of accumulated cost pressures; and ii) not all the restaurants revised their prices immediately after the normalization steps and some of the impact on prices will only be observed when the remaining unchanged prices are changed, which means that our estimations show only a part of the total impact. In addition to contributing to several strands of the literature, our results have implications for the ongoing debate about whether the observed high levels of inflation around the world in the post-normalization period are transitory or will persist. We have demonstrated that when the demand for food services converges to pre-pandemic levels, prices show steep increases. Because normalizations are one-shot events, our results suggest that at least a part of the increasing inflation is transitory.

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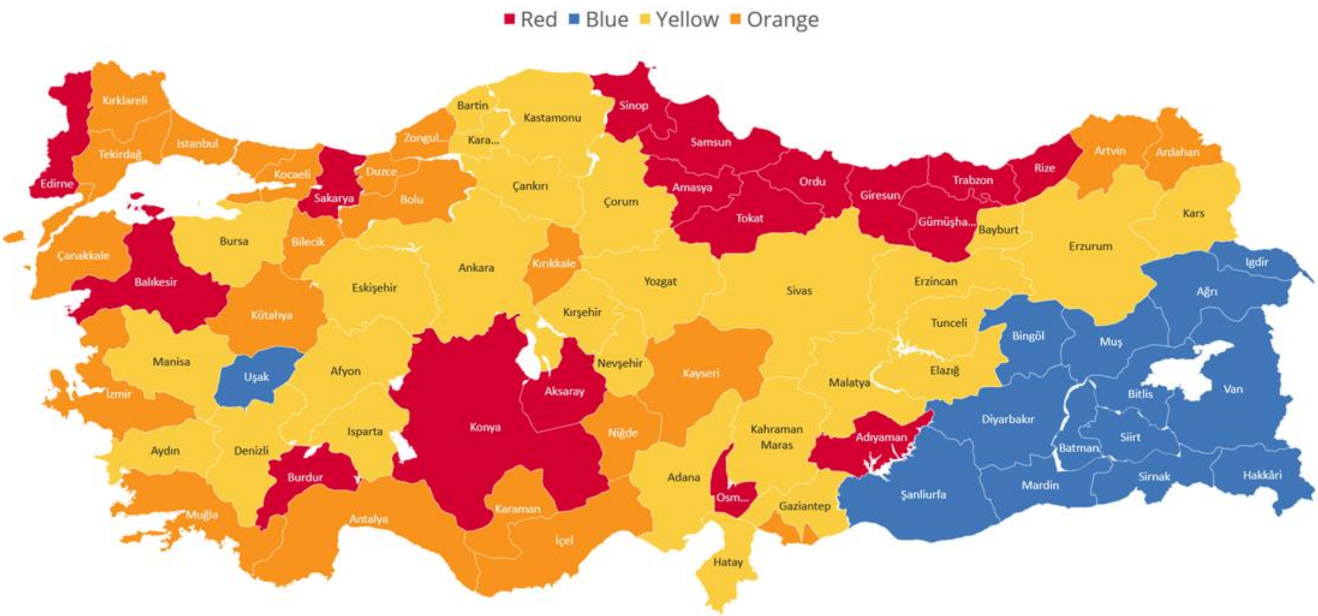
Appendix

Table A1: Normalization Effects of June 2020, March 2021, and June 2021 (High Frequency)

Window Width		Polynomial Order: 2 6 Months	8 Months
June 2020		1.12*** (0.77, 1.42)	1.16*** (0.99, 1.45)
March 2021	Türkiye	0.06 (-0.43, 0.94)	-0.04 (-1.27, 0.69)
	Blue	-0.49 (-1.32, 1.08)	-1.05** (-2.9, -0.03)
	Yellow	0.26 (-0.24, 1.5)	0.1 (-1.38, 1.01)
	Orange	0.08 (-0.46, 0.77)	0.03 (-1.11, 0.77)
	Red	-0.53 (-1.41, 0.85)	-0.76** (-1.64, -0.13)
June 2021		1.54** (0.68, 4.88)	1.54** (0.78, 3.1)

***, **, and * show statistical significance at 1%, 5%, and 10% levels, respectively. While confidence intervals presented in the parentheses were calculated, standard errors were clustered by the date of observation and the wild bootstrap method was applied.
Source: Authors' calculations.

Figure A1: Color Codes of Provinces



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